# National Institutes of Health support of rehabilitation robotics research

An important issue in determining current and future National Institutes of Health (NIH) support of rehabilitation robotics research is definitional: What constitutes robotics? Certainly, a wide range of devices are incorporating increasingly sophisticated microprocessors for control and identification. In the current context, we define robotics as semiautonomous systems that provide assistance or therapeutic modalities to patients. Such devices are inherently programmable and their function can be tailored to patients' individual needs.

The NIH anticipates growing interest in research on the application of robotics to rehabilitation. The demographic "bulge" in the United States as a result of an aging "baby boomer" generation will increase the premium on more cost-effective delivery of therapy services. The success of "massed practice," i.e., intensive physical rehabilitation interventions [1], has naturally led to a demand for automated systems that patients can use several hours daily at home rather than at outpatient clinics. Robotic devices not only can provide far more accurate, continuous monitoring of patient performance than clinicians but also they can adapt to changes in patient performance [2]. Clinical trials of interventions are potentially easier with robotic devices, since the devices can be programmed to deliver equivalent stimuli across patients and sites. Thus, the use of devices such as the Lokomat, a robotic gait orthosis, may prevent some of the difficulties encountered in trials of body-weight-supported treadmill walking [3].

Conversely, robotic applications for more general assistance in activities of daily living (eating, dressing, bathing, etc.) or instrumental activities of daily living (housework, shopping, etc.) appear to be much further in the future. Such applications will require development of more sophisticated control and safety systems, as well as new compact power supplies. Current commercially available robotic applications are limited to vacuum cleaners and lawn mowers. The development of more general-purpose robotic devices for individuals with disabilities is unlikely to occur prior to market demand for such devices by the general population.

Current NIH support for research on robotics in rehabilitation includes support for basic science, including fundamental engineering and clinical applications. Institutes supporting this research include the National Institute of Biomedical Imaging and Bioengineering (NIBIB), the National Institute of Child Health and Human Development (NICHD), and the National Institute of Neurological Disorders and Stroke. Support mechanisms range from individual fellowship and career development awards to research project awards and center grants. Particularly notable is NICHD support of a major center at the Rehabilitation Institute of Chicago (grant R24HD039627, refunded under grant R24HD050821), where multiple projects are investigating the use of robotics for improving function in patients with stroke and neurological injuries. See http://www.ncmrr.org/Sites/RehabilitationInstituteofChicago/tabid/200/Default.aspx for more information on this project.

NIBIB and NICHD are also supporting the development of lightweight, low-cost robotic devices that will assist in the rehabilitation of stroke patients with arm paralysis. Some of these devices will be ready for clinical trials in the near future. See http://www.eurekalert.org/pub_releases/2005-05/asu-art050405.php for information on one such device, Robotic Upper Extremity Repetitive Therapy.

Various investigations are also exploring the use of robotic devices for improving recovery in animal disease models. In addition, the NIH supports a vigorous program of device development through Small Business Innovation Research grants. Projects supported include the development of communication aids, sensory feedback, intelligent wheelchairs, and robotic therapy aids.

NIH funding for research on the application of robotics to recovery and rehabilitation will continue largely through investigator-initiated grant applications. Approximately 80 percent of the NIH budget for extramural grant support is devoted to investigator-initiated applications, and this percentage is not likely to shift in the near future. The historic doubling period of the NIH budget is now over, and many analysts project more modest budget increases over the coming years. This more limited budget, in turn, could increase the uncertainty associated with funding large new initiatives, especially costly clinical trials, such as those that involve robotic interventions.

However, investigators should refer to the following current published Program Announcements (PAs) requesting research applications because they indicate strong NIH interest in rehabilitation robotics:

- Extension of Bioengineering Research Grant (PA-02-011): http://grants.nih.gov/grants/guide/notice-files/NOT-EB-06-006.html
- Neurotechnology Research, Development, and Enhancement (PA-06-278): http://grants.nih.gov/grants/guide/pa-files/PA-06-278.html
- Neurotechnology Research, Development, and Enhancement (PA-06-279): http://grants.nih.gov/grants/guide/pa-files/PA-06-279.html
- Research Partnerships for Improving Functional Outcomes (PAR-04-077): http://grants.nih.gov/grants/guide/pa-files/PAR-04-077.html

## REFERENCES

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***Michael Weinrich, MD***
National Center for Medical Rehabilitation Research, NICHD, NIH, Rockville, MD

Email: mw287k@nih.gov

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